Magnetic Head Dicing Process

ADT = Dicing

Advanced Dicing Technologies
Basic function of head = reading information on the hard disc

Magnetic head mounted to a SS suspension arm

Air gap (0.001 - 0.002 mm)
Magnetic Head Slider

Physical Properties of Al2O3-TiC:

<table>
<thead>
<tr>
<th>Color</th>
<th>Density (g/Cm3)</th>
<th>Hardness (HV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>4.2</td>
<td>2100</td>
</tr>
</tbody>
</table>

Base material - Alumina + Titanium Carbide

Material to dice:
AL Titanium Carbide [ALTEC]

Sliders are composed of Al2O3 - TiC composite with a thin 10 - 20nm diamond like carbon protective overcoat

ADT = Dicing
General Manufacturing process flow:
- Wafer Fabrication
- Wafer Mounting
- External shaping / dicing for reference
- Second wafer mounting [On some applications]
- Row Slicing
- Lapping the rows in reference to the coil
- Aligning and stack mounting of rows
- Head Parting

- Related to the dicing process
Magnetic Head Slider

- **Wafer Fabrication options:**

  - Al₂O₃-TiC square subst.
  - Segments of rows To be diced from the Al₂O₃ - TiC wafer
  - ~ 8” Dia. Al₂O₃ - TiC wafer
  - Al₂O₃-TiC round wafer
• **Wafer / substrate Mounting**

[Gluing or mechanical mounting]

Lava or metal fixture

Magnetic Head Slider
• **External shaping / Dicing:**
  - **Blade** - Depending on the process requirements:
    - Nickel or metal sintered x 4-8 & 10mic. Diamond grit
    - On some square substrates this step is part of the next row slicing process

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**Ear dicing**

Optional on some processes

**Cut direction**
• **2nd wafer mounting [On some application]**
  [Glue or Vacuum to metal fixture]
**Row Slicing:**

- Blade: Nickel electroformed x 0.100 - 0.150mm Thickness x 4-8, 10 or 17mic. Grit
- Cut perpendicularity: ~ 0.002 - 0.005mm depending on wafer thickness
- Cut straightness [Skew]: ~ 0.002 - 0.005mm depending on cut length
- Chipping: ~ 0.004 – 0.008mm depending on the application (Usually not an issue)

Row slicing on Lava

Row slicing on metal fixture
• **Lapping the rows in reference to the coil geometry:**

Lapping the row sides for straightness & electrical properties
• Aligning and stack mounting of rows:
  [A delicate & accurate process]

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Grove releases on fixture
Or dicing into a soft media

Bars

Mounting fixture

Adhesive
**Head Parting:**

- **Blade being used:**
  - Nickel binder x 3 - 6 mic. Or 4-8 mic.
  - x ~ 0.060 - 0.100 mm thick
  - [On some application a thicker blade is used]

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**Center to Center lines**

**Final head size**
Important process parameters:

- **Blade mounting and O.D. grinding**

![Diagram showing blade mounting and O.D. grinding with labels for Sil. Car. Grinding Wheel, Blade, Flange, Arbor, and Work piece rotation.](image)

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*ADT = Dicing*
O.D. grinding on the KOL cylindrical grinder

Magnetic Head Slider

O.D. grinding on the KOL cylindrical grinder
• **Blade Dynamically balancing:**
  common spec - < 0.001cm / sec

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Front flange grip

Flange

8-12 set screws for balancing

Blade

Spindle nut
Cont.

• **On Line dressing**
  - Blade is passing the dressing media each index or every few cuts on a dressing station -
  - To be optimized.

- Silicon Carbide or Al. Oxide Dressing media
  [600 up to 1000 mesh]
Blade testing for spec:
- Blade must be functionally tested on Al2O3 - TiC substrate after the O.D. grinding process and prior to starting production.

Blade Coolant:-
- Special additive to the cooling system must be used to lower the surface tension of the coolant and to better lubricate the blade during the dicing.
- Use lower pressure with high coolant volume, Important to eliminate any blade deflection.
Proper mounting:
- Eliminate any movement of bars
  [Skew and blade Walk]
- Optimize the glue type to minimize blade overloading
Quality criteria's for the row slicing & the parting:

General remark:
The quality criteria’s spec depends on the customer application. All spec criteria's are in the microns range and do vary between customers.

Factors effecting TSC & BSC:
- Substrate type (Material Thickness etc.)
- Blade matrix
- Diamond grit size & Conc.
- Coolant
- Blade vibration [balancing]
- Mounting
- Optimized dicing parameters
**Cut perpendicularity:**

Factors effecting cut perpendicularity:
- Blade matrix [Loading]
- Blade exposure
- Flange condition
- Coolant type and pressure
- Mounting
- Optimized dicing parameters

Measured optically in microns
• Wheel walk & Skew:

- Wheel walk is mainly a factor of the blade stiffness, blade exposure, wafer material [Loading] and the accuracy of the dicing saw
- Skew is mainly a factor of the blade matrix, part mounting / part movement during the dicing, wafer material [loading], accuracy of the saw [alignment] and accuracy of the wafer streets.
Surface finish on the kerf wall:

Factors that are effecting the surface finish:
- Blade binder & diamond grit size
- Wafer material
- Saw accuracy
- Blade exposure
- Spindle speed & feed rate
- Coolant type
- Blade vibrations - dynamically balancing
- Mounting

Surface finish Measured in Angstroms
ADT typical recommended blades for Dicing magnetic head applications:

Row slicing:
- Nickel Electroformed - 4-8, 10 & 17mic. Grit
  Thickness of 0.090mm & over

Parting:
- Nickel Electroformed - 3-6, 4-8mic. Grit
  Thickness of 0.060mm & over

All blades are available in 2.0” [50mm] up to 4.30” [109.22mm] Diameters. Special diameters can be made.

Other blade matrixes or blade parameters can be tailor made and optimized for special application requirements.
Typical qualification tests for the Row Slice process:

Blade P/N - 04776-7301-038-ALO
Blade thickness – 0.092mm

- Nice edge / min radius
- Kerf - < 0.097mm
- Min chipping
Typical qualification tests for the Parting process:
4B777-ENGN-135
Blade thickness – 0.062mm

• Nice edge / min radius
• Kerf - ~ 0.066mm
• Min chipping
Blade P/N - ENGN-134 Wheel room test cut: (At the customer site)
Kerf – 0.064mm
Right perpendicularity – 0.001mm
Left perpendicularity – 0.002mm
Right radius – 0.008mic.
Left radius – 0.007mic.

Row part test after conditioning: (At the customer site)
Kerf – 0.065mm
Right perpendicularity – 0.002mm
Left perpendicularity – 0.001mm
Right radius – 0.008mm
Left radius – 0.007mm
Blade parameters to be optimized:

- Blade geometry – Diameter, thickness
- Matrix hardness
- Diamond %
- Diamond size & type